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F01 Wiper/Washer System

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Wiper/Washer System

Model: F01/F02

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Understand the operation and functions of the wiper/washer system
- Locate and identify wiper/washer system components

Introduction

Windscreen Wipers

The F01/F02 has a wiper/washer system for the windscreen as standard.

Windscreen wiping has the following functions:

- Continuous wipe in stage 1
- Continuous wipe in stage 2
- Flick wipe.

The following systems are also available:

- Headlight washer system
- Water jet heater
- Automatic mode using the rain/light/solar/condensation sensor.

The wiper motor for the wiper/washer system is connected via a LIN bus.



Rain/lights/solar/condensation Sensor

The rain/lights/solar/condensation sensor is the same as the rain/driving lights/solar sensor, but has been enhanced with the condensation sensor function. The functionality of the rain sensor, the driving lights sensor and the solar sensor have been retained in full. This means, for example, that the driver is still assisted by the rain sensor automatically initiating the procedure for switching on the windscreen wipers.

The automatic wiping does not relieve the customer from the responsibility of wiping the windscreen. For this reason, the customer can override the automatic wiping function at any time by moving the wiper switch on the steering column stalk up or down or pulling it towards him.

The driving lights sensor supplies the on and off signal for the automatic driving lights control function.



Index	Explanation
1	Rain/light/solar sensor (not F01)



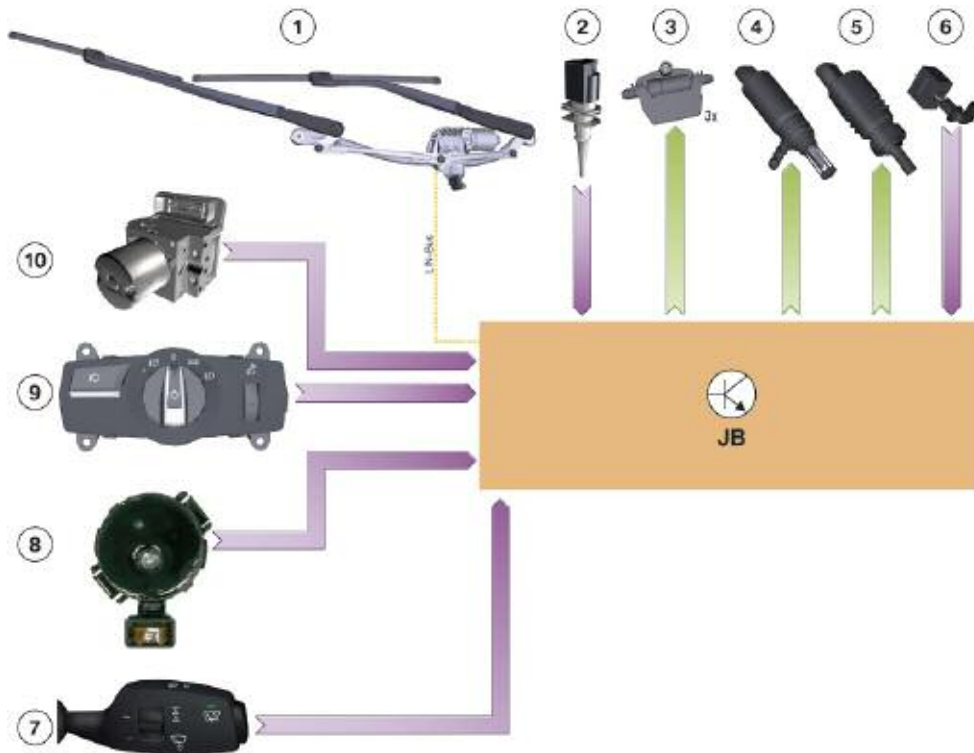
Index	Explanation
1	Rain/light/solar sensor
2	Sensor for HUD
3	Condensation sensor

Under unfavorable light conditions such twilight or when driving through a tunnel, the ON signal ensures the driving lights are switched on automatically.

The solar sensor makes sure the automatic climate control system provides optimum air conditioning distribution in the vehicle.

The condensation sensor allows the integrated automatic heating/air-conditioning system to detect when condensation is forming on the windscreen in good time, even before the driver is aware of it. Countermeasures can be taken automatically at an early stage, without the need for driver intervention.

System Overview



Index	Explanation	Index	Explanation
1	Front wiper motor with wiper	7	Wiper switch on the steering column stalk
2	Outside temperature sensor	8	Rain/lights/solar/condensationsensor
3	Heated washer jet 3x *	9	Lights operating unit
4	Headlight washer system motor	10	Dynamic stability control
5	Washer fluid pump motor	LIN-Bus	Local Interconnect Network bus
6	Washer fluid level sensor	JB	Junction box electronics

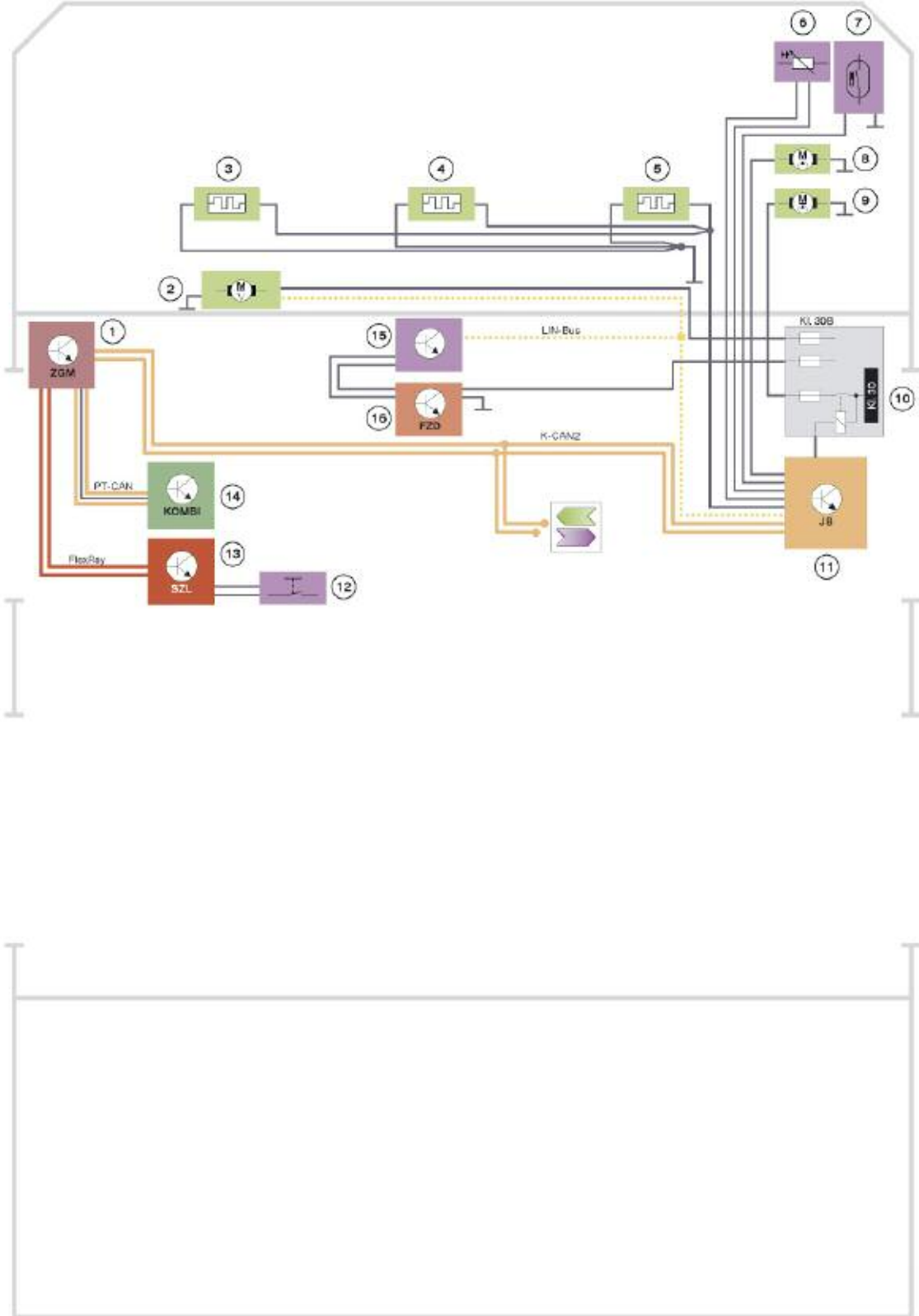
* Heated washer jets on the driver's side, in the center and on the front-passenger side

When the wiper switch on the steering column stalk (7) is operated, the wiper motor (1) is switched on or off. The junction box electronics execute the functions of the wiper/ washer system. The motor for the washer fluid pump (5) or for the headlight cleaning system (4) is switched on or off by the junction box electronics.

On vehicles with automatic driving lights control, the junction box electronics receive the information about switching the wiper/ washer system on/off from the rain/lights/solar/ condensation sensor (8).

The Dynamic Stability Control (10) provides information about the vehicle speed.

System Circuit Diagram for the Wiper/washer System



Index	Explanation	Index	Explanation
1	ZGM central gateway module	12	Wiper switch on the steering column stalk
2	Wiper motor	13	Steering column switch cluster (SZL)
3	Heated washer jet on the driver's side	14	Instrument cluster
4	Heated washer jet in the center of the vehicle	15	Rain/lights/solar/condensation sensor
5	Heated washer jet on the front-passenger side	16	Roof functions center (FZD)
6	Outside temperature sensor	KI. 30	Terminal 30
7	Washer fluid level sensor	KI. 30B	Terminal 30 basic operation
8	Washer fluid pump motor	K-CAN2	Body CAN2
9	Motor, headlight washer	PT-CAN	Powertrain CAN
10	Front distribution box	LIN-Bus	Local Interconnect Network bus
11	Junction box electronics (JB)		

The signal produced when the wiper switch on the steering column stalk (12) is operated is sent from the SZL steering column switch cluster (13) via the FlexRay to the central gateway module (1). The central gateway module transmits the signal on the K-CAN2. The junction box electronics (11) switch the wiper motor (2) on, for example and monitor its function.

The washer fluid pump (8) is switched on or off by the junction box electronics.

On vehicles with automatic driving lights control, the rain/lights/solar/condensation sensor (15) sends the request to switch on the wiper motor, for instance, via the LIN bus. The junction box electronics receives the request and implements it.

The roof function center (16) supplies the voltage for the rain/lights/solar/condensation sensor.



K-CAN2 signals to the junction box electronics

In/Out	Information	Source/Recipient	Function
In	Vehicle speed	Wheel speed sensor > Dynamic Stability Control	Wiper speed setting depending on vehicle speed
Out	Wiper status	Wiper motor > Junction box electronics	Information for driver assistance systems that involve a video camera at the base of the rear view mirror

Functions

Wiping

The wiper/washer system is switched on and off with the wiper switch. The wiper switch is an integral part of the steering column switch cluster SZL.

Wiper Switch

The wiper switch on the steering column stalk does not lock in position. It always returns to its start position after every operation. The button for the rain/lights/solar/condensation sensor also returns to its starting position after every operation. The wiper-stage switch does lock in position.

The following functions are switched on with the wiper switch on the steering column stalk:

- Automatic wipe with rain/lights/solar/ condensation sensor
- Continuous wipe, stage 1
- Continuous wipe, stage 2
- Flick wipe
- Wash windscreen

The signals from the wiper switch on the steering column stalk are sent from the steering column switch cluster via the FlexRay to the central gateway module. From the central gateway module, the signal is transmitted to the junction box electronics via the K-CAN2. The junction box electronics evaluates the signals and actuates the wiper motor via the LIN bus. The junction box electronics also monitor the wipe function via the LIN bus. To do so, the junction box electronics cyclically request the status of the wiper motor.

■ Directions of movement



Index	Explanation
0	Steering column stalk/start position of wiper-stage switch
1	Wiper stage 1
2	Wiper stage 2
3	Wiping while steering column stalk operated
4	Activates/deactivates the rain/lights/solar/condensation sensor
5	Washer fluid and windscreen wiper at same time
6	Increases the sensitivity of the rain/lights/solar/condensation sensor
7	Reduces the sensitivity of the rain/lights/solar/condensation sensor

Windscreen Wipe Function

The following functions are available for wiping the windscreen:

- Intermittent wipe in stages
- Automatic wipe
- Continuous wipe, stage 1
- Continuous wipe, stage 2
- Flick wipe.

■ Intermittent wipe

The interval can be set with the multi-stage switch. Four intermittent wipe stages are available. The time intervals depend on the set intermittent wipe stage and the vehicle speed. The junction box electronics calculate the time intervals and actuate the wiper motor accordingly.

■ Automatic wipe

The automatic wipe function can be activated by pressing the axial button from status “terminal R ON”. The LED on the wiper switch indicates that the function is active. A one-off wipe function (acknowledgement wipe) is additionally started. The acknowledgement wipe is also initiated when the wipe interval is increased by means of the wiper-stage switch but not when the wipe interval is decreased.

The rain/lights/solar/condensation sensor initiates wipe requests according to the heaviness of the rain. The junction box electronics analyze the signal from the rain/lights/solar/condensation sensor every 20 ms. For this, the junction box electronics request the relevant signal values and execute the windscreen wipe according to the wipe request.

With the automatic wipe function, the wipe speed depends on the information from the rain/lights/solar/condensation sensor, i.e. continuous wipe stage 1 or stage 2 may be initiated depending on the rain intensity.

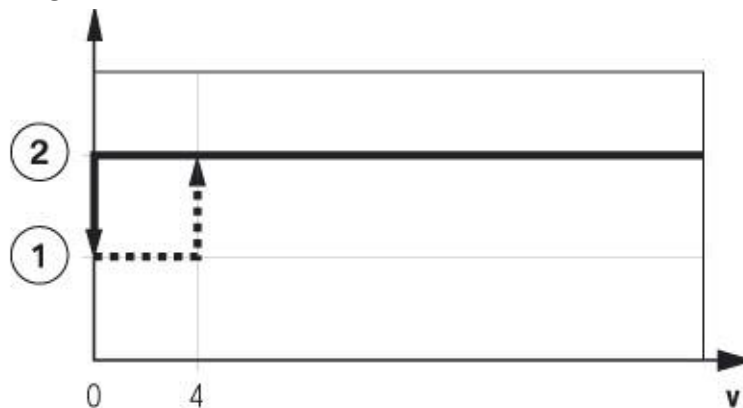
■ Continuous wipe, stage 1

The wiper motor runs at normal speed when stage 1 is switched on with the wiper switch on the steering column stalk. The wiper motor switches from continuous wipe in stage 1 to intermittent wipe if the vehicle speed is reduced down to standstill.

The continuous wipe function in stage 1 resumes as soon as the vehicle speed is higher than 2.5 mph (4 km/h).

The reset (switch-back) of the wiper stage when the vehicle is stationary can be decoded. In this case, the wiper blades operate in continuous wipe stage 1 mode also when the vehicle is stationary.

Continuous wipe, stage 1



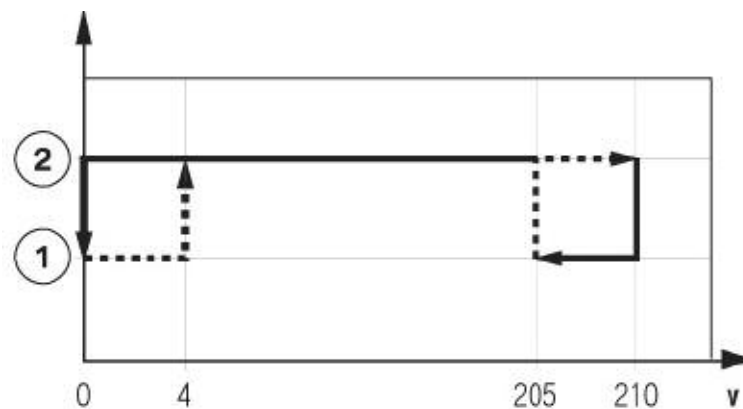
Index	Explanation
1	Intermittent wipe
2	Continuous wipe, stage 1
v	Vehicle speed in km/h

Continuous wipe, stage 2

The wiper blades are moved at double the speed in continuous wipe stage 2. When the vehicle is stationary, continuous wipe stage 2 automatically switched back to continuous wipe stage 1. The wiper blades then move at normal speed. Stage 2 is resumed again at a speed in excess of 2.5 mph (4 km/h).

The wipe function switches back to stage 1 at a speed in excess of 130 mph (210 km/h). Stage 2 is switched on again at a speed below 127 mph (205 km/h).

Decreasing wiper stage (continuous wipe stage 2)



Index	Explanation
1	Continuous wipe stage 1
2	Continuous wipe stage 2
v	Vehicle speed in km/h

The reset of the wiper stages when the vehicle is stationary can be decoded. In this case, continuous wipe stage 2 is retained also when the vehicle is stationary.

■ **Flick wipe**

Pressing the wiper switch on the steering column stalk triggers the flick wipe function for as long as the switch is pressed. When the wiper switch on the steering column stalk is released, the wiper movement is completed until the wiper blades reach the rest position.

Windscreen Wiper Anti-blocking Function

The windscreen wiper anti-blocking function is integrated into the electronics of the wiper motor. If the wiper motor is obstructed, the electronics cease the actuation of the motor. The electronics communicate this via the LIN bus the next time the junction box electronics query the status.

A further attempt can be made to switch on the wiper. If the wiper blocks again, it will no longer be operative for approximately 3 minutes.

The wiper interlock is cancelled when the status is switched from "terminal R ON" to "terminal R OFF". The wiper must then be switched on again.

Wash Functions

■ **Wash windscreen**

When the wiper switch on the steering column stalk is pulled, the washer fluid pump is first switched on, followed by the windscreen wiper. The washer fluid pump remains switched on for as long as the wiper switch on the steering column stalk is pulled.

The signal is routed from the steering column switch cluster via the FlexRay to the central gateway module. It is then transmitted from the central gateway module via the K-CAN2 to the junction box electronics. The junction box electronics actuate the washer fluid pump directly.

After the pump is switched off, the wipers continue to operate for several wipe cycles in order to wipe the windscreen dry.

The wipe function set before the windscreen wash cycle is continued after the windscreen has been washed.

The junction box electronics will no longer actuate the washer fluid pump if the fluid level in the washer fluid reservoir is too low. The junction box electronics receive the information necessary for this purpose from the washer fluid level sensor.

■ **Washer fluid level sensor**

The junction box electronics monitor the washer fluid level sensor from terminal status "terminal R ON". The washer fluid sensor is integrated in the washer fluid reservoir and is switched to ground.

The junction box electronics receive a low signal when the washer fluid reservoir is full. The switch opens when the fluid level in the washer fluid reservoir drops below a certain

level. The low signal changes to a high signal. The junction box electronics consequently generate a message indicating the low level in the washer fluid reservoir.

■ **Terminal 50**

The washer function is interrupted or not at all started while the vehicle is started.

If the windscreen washer function was interrupted, the started function is continued after the vehicle start procedure has been completed.

Headlight Washer System

The headlight washer system is switched on during the first wash cycle after terminal status “terminal R ON” and “lights ON”. Activation is then suppressed for 7 min. The headlight washer system is activated if the windscreen washer system is operated 5 times within the 7 minutes.

In response to the request from the junction box electronics, the headlight washer system is switched on by means of a relay in the distribution box.

The headlight washer system is no longer activated if the washer fluid level in the washer fluid reservoir is too low. The junction box electronics receive the signal from the washer fluid sensor.

The headlight washer system is not actuated either if obstruction of the wipers is detected.

■ **BMW Night Vision**

If the vehicle is equipped with BMW Night Vision with person recognition, the Night Vision Camera lens is cleaned at the same time as the headlights. The pump in the headlight washer system supplies water to all the washer jets for the headlights and the Night Vision Camera.

System Components

Involved Components

The following components are involved in the wiper/washer system:

- Control units
 - Steering column switch cluster
 - Central gateway module
 - Junction box electronics
 - Instrument cluster
 - Dynamic stability control
- Rain/lights/solar/condensation sensor
- Wiper switch on the steering column stalk
- Relay for headlight washer system
- Wiper motor
- Washer fluid pump
- Pump for headlight washer system
- Heated washer jets

Control Units

■ Steering column switch cluster

The steering column switch cluster evaluates the status of the wiper switch on the steering column stalk. The respective status is issued by the steering column switch cluster on the FlexRay.

■ Junction box electronics

The junction box electronics is the central control unit for all wipe and wash functions.

The junction box electronics communicate the current wipe requirement via the LIN bus. This request is received by the electronics in the wiper motor and the relevant wiper stage is initiated.

A separate relay is fitted in the front distribution box for the headlight washer system.

■ Dynamic stability control

The Dynamic Stability Control provides the road speed signal.

■ Rain/lights/solar/condensation sensor

The rain/lights/solar/condensation sensor consists of four sensors. The rain sensor is used for the wiper/washer system.

Condensation sensor

The condensation sensor consists of a sensor element with integrated processor on a flexibly mounted circuit board. The condensation sensor records the relative air humidity and the temperature on the inside of the windscreen.

The rain/lights/solar/condensation sensor is integrated in the base of the mirror and is held in place by a spring on a retaining plate. The retaining plate is securely bonded to the inside of the windscreen.

The visual connection between the rain/lights/solar/condensation sensor and the windscreen is formed by a silicone gel layer on the optical element. The condensation sensor is mounted directly on a “flexible” circuit board.

Due to the specified installation location, the flexible circuit board with the condensation sensor is pushed against the windscreen. This ensures a good thermal connection with the windscreen. A permeable membrane made from Teflon protects the condensation sensor from becoming dirty.

Fault code memory entries for the function of the rain/lights/solar/condensation sensor are stored in the junction box electronics.

If the condensation sensor fails, the junction box electronics transmits this via the K-CAN2. The central gateway module transmits the information on the K-CAN. The integrated automatic heating/air-conditioning system thus receives the information and deactivates the program to prevent condensation from forming on the windscreen.

Note: Replacing the rain/lights/solar/ condensation sensor:

It is permissible to replace a rain/lights/solar/ condensation sensor as long as no bubbles occur in the silicone gel layer (adhesive layer) when you do so. Please remember to initialize the sensor. Refer to the Repair Instructions for more information.

Wiper Switch on the Steering Column Stalk

The wiper switch on the steering column stalk with the following functions is located in the steering column switch cluster:

- Intermittent wipe
- Wipe in stages 1 and 2
- Windscreen washer
- Headlight washer
- Switch for the rain/lights/solar/condensation sensor
- Indicator for activated rain/lights/solar/ condensation sensor.

The wiper switch has sliding contacts that are located on the circuit board for the steering column switch cluster. The switch functions are realized by means of these sliding contacts.

The interval switch is a four-stage switch. Each stage produces different input values in the steering column switch cluster. The input values are evaluated for setting the sensitivity of the rain/lights/solar/condensation sensor or the intermittent wipe stage.

The button for the rain/lights/solar/ condensation sensor is designed as an ground-switching button. It is required for switching on the rain/lights/solar/condensation sensor. The LED is illuminated when the rain/lights/solar/ condensation sensor is activated.



Index	Explanation
1	Wiper switch on the steering column stalk
2	Wiper-stage switch for sensitivity of the rain sensor/intermittent wipe stage
3	Rain/lights/solar/condensation sensor LED
4	Rain/lights/solar/condensation sensor button

Function matrix for the wiper/washer system steering column stalk

Operation	Initial state	Function	Design
Push upwards briefly	OFF	Wipe 1	Returns to initial position
	Continuous wipe, stage 1	Wiper stage 2	Returns to initial position
	Continuous wipe, stage 2	Wiper stage 2	Returns to initial position
Push upwards	OFF	Wiper stage 2	Returns to initial position
	Continuous wipe, stage 1	Wiper stage 2	Returns to initial position
	Continuous wipe, stage 2	Wiper stage 2	Returns to initial position
Push downwards briefly	OFF	Flick wipe	Returns to initial position
	Continuous wipe, stage 1	Intermittent wipe	Returns to initial position
	Continuous wipe, stage 2	Wiper stage 1	Returns to initial position
Pull briefly towards the driver	OFF	Windscreen wash	Returns to initial position
Turn the knurled wheel up/down	Sensitivity of the rain/ lights/solar/ condensation sensor Intermittent wipe stage	Sets the sensitivity of the automatic wiping or intermittent wiping	Engages in position

Function matrix of the steering column stalk for the wiper/washer system with automatic wiping by the rain/lights/solar/condensation sensor

Operation	Initial state	Function	Design
Push upwards briefly	OFF	Wiper stage 1	Returns to initial position
	Automatic mode	Wiper stage 1	Returns to initial position
	Continuous wipe,	Wiper stage 2	Returns to initial stage 1 position
	Continuous wipe,	Wiper stage 2	Returns to initial stage 2 position
Push upwards	OFF	Wiper stage 2	Returns to initial position
	Automatic mode	Wiper stage 2	Returns to initial position
	Continuous wipe,	Wiper stage 2	Returns to initial stage 1 position
	Continuous wipe,	Wiper stage 2	Returns to initial stage 2 position
Push downwards briefly	OFF	Flick wipe	Returns to initial position
	Automatic mode	Flick wipe*	Returns to initial position
	Continuous wipe,	Intermittent wipe	Returns to initial stage 1 position
	Continuous wipe,	Wiper stage 1	Returns to initial stage 2 position
Pull briefly towards the driver	OFF	Windscreen wash	Returns to initial position
Briefly push the automatic wipe button in an axial direction	Automatic wipe switched off	Automatic wipe ON	Returns to initial position
	Automatic wipe switched on	Automatic wipe OFF	Returns to initial position
Turn the knurled wheel up/down	Sensitivity of the rain/lights/solar/ condensation sensor	Sets the sensitivity of the automatic wiping or	Engages in position

Wiper Motor

The front wiper motor is a little smaller than the wiper motor in the E65.

Advantages of the wiper motor:

- Lighter
- Less noise
- Reversing wiper motor
- Stable wiper speed
- Reduced tendency of the wiper blades to judder
- Alternating rest position of the wiper blades.

The wiper motor has two speed settings for wiping the windscreen.

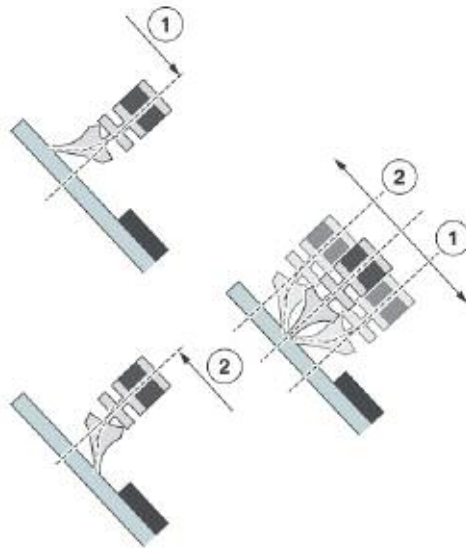
The wiper motor receives information about the wiper stage via the LIN bus.

The LIN-bus messages are evaluated by electronics in the wiper motor.

A constant speed is generated by the electronics, enabling consistent wiping by the windscreen wipers.

The wiper motor stores the wiper arms, and therefore also the wiper blades, outside the field of vision, as in the E65. In addition, they are stored on alternate sides. This prevents unnecessary wear on the wiper blades and they will remain pliant for longer.

Storage position 2 of the wiper



Index	Explanation
1	Storage position 1 of the wiper blade
2	Storage position 2 of the wiper blade

Washer Fluid Pump

A washer fluid pump is located in the washer fluid reservoir for cleaning the windscreen. The pump is actuated directly by the junction box electronics.

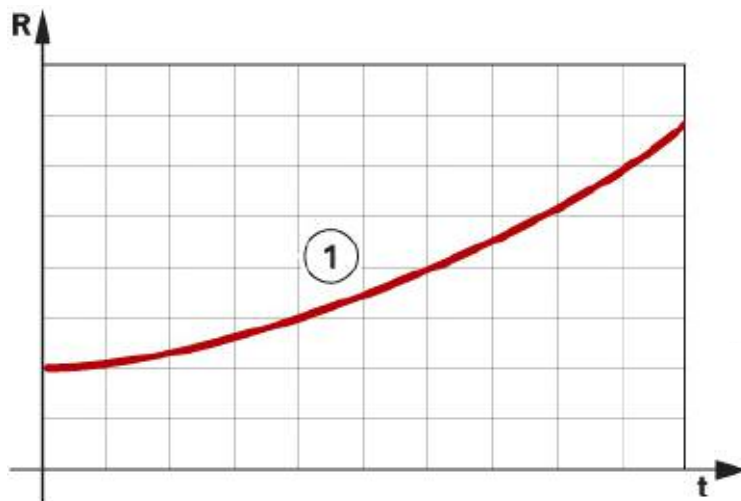
Pump for Headlight Washer

A high pressure pump is used for the headlight washer system. The pump is activated via a relay in the front power distribution box.

Heated Washer Jets

Three heated water jets are used for the windscreen washer. The washer jets have a PTC resistor that automatically limits the power consumption.

Characteristic of a PTC resistor



Index	Explanation
1	Characteristic of a resistor
R	Resistance
t	Time

Service Information

Wiper/washer System Emergency Operating Functions

Emergency Operation in the Event of the Steering Column Switch Cluster Failing

The wipers can no longer be operated in the event of the steering column switch cluster failing or a break in the bus connection.

The junction box electronics switch to emergency operating mode and the windscreen wipers are switched on in stage 1.

Emergency Operation if the Rain/lights/solar/condensation Sensor Fails

If there is a fault in the rain/lights/solar/condensation sensor or it fails completely, the junction box electronics take over control of the wiper/washer system and switch to emergency operating mode. Emergency operating mode is an intermittent wipe function that is dependent on the vehicle speed.

Note: The same applies if the rain/driving lights/solar sensor fails.

Replacement of the Rain/lights/solar/condensation Sensor

The following steps are necessary after replacing the sensor:

- Code the rain/lights/solar/condensation sensor
- Clear fault code memory
- Initialize the rain/lights/solar/condensation sensor.

Please refer to the Repair Instructions.

Note: The same applies to the replacement of the rain/driving lights/solar sensor.

Replacement of the Wiper Motor

The wiper motor is connected to the LIN bus and this must be taken into consideration during the service.

Note: The Repair Instructions must be observed when the wiper motor is replaced. If the LIN bus fails, the wiper will go into emergency operation.

Replacing the Wiper Blades

The wiper arms can be moved to a service position in order to replace the wiper blades. This makes the wiper blades easily accessible and allows them to be replaced.

■ Activating the service position

- Switch on the ignition with the START/STOP button
- Switch off the ignition with the START/STOP button
- Operate the wiper switch on the steering column stalk (push it upwards and hold it there for more than three seconds).

The wiper arms now move into the service position (the upper reversal position of the wiper blades) and the wiper blades can be replaced.